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PREJUDGING THE SUCCESS OF AN EXPERIMENTAL PROJECT.

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JOINTLY CONSIDERING THE FACTORS OF SAMPLE SIZE (N-10 TO N-1000) AND THE STANDARD DEVIATION OF THE CRITERION MEASURE (SD-1 TO SD-25), A TABLE SHOWS THE DIFFERENCE BETWEEN TREATMENTS NEEDED FOR STATISTICAL SIGNIFICANCE AT THE .05 LEVEL. THUS, IF THE EDUCATIONAL RESEARCHER HAS APPROPRIATE INFORMATION ON PAST PERFORMANCE, HE CAN CONSULT THE TABLE TO DETERMINE THE SAMPLE SIZE NEEDED TO OBTAIN A DIFFERENCE OF A GIVEN ANTICIPATED SIZE AND ALSO THE TIME OR LENGTH OF PROJECT NECESSARY TO ACHIEVE A DIFFERENCE OF THE DESIRED SIZE. THIS ARTICLE WAS PUBLISHED IN THE "ARGR JOURNAL," VOLUME 3, NUMBER 1, NOVEMBER 1966. (LC)

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PREJUDGING THE SUCCESS OF AN EXPERIMENTAL PROJECT

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Adequate experimental design has long been considered an integral part of any research project. All too often, however, educational experiments are inaugurated without consideration of the probability of success. This is especially tragic if the initiator's professional reputation rests upon the success of the experiment.

Federal support of education now carries with it the concomitant responsibility of research. Experimentation with small groups, a natural corollary of emphasis upon specific problem areas such as underachieving, and gifted children, is further encouraged by Title I emphasis upon underprivileged children. Only large cities have within their environs considerable numbers of underprivileged children. The remaining schools must work with reduced numbers. As the number of children involved decreases, the probability of obtaining significant results decreases. The decrease is especially marked below an N of 100.

Also to be considered in estimation of probable success of an experiment is the size of the deviation of the test instrument. As this deviation rises, the necessity of showing larger experimental-control differences also increases.

The above two factors should be considered before an experimental program is actually put into operation. Table 1 below combines the two factors of sample size and test deviation. The number at the junction of any row and column is the deviation which can occur by chance and therefore must be exceeded in experimental results in order that the findings may be considered significant. The numbers in each cell represent two standard deviations or approximately .95 significance. That is, any experimental result exceeding the number at the junction of the proper row and column will occur by chance only five times in a hundred.

An example of the practical use of the table will aid understanding. Let us hypothesize the dilemma of an administrator who wishes to set up a special reading program for low achievers in grades four, five, and six. The primary purpose is to raise the reading level of the children. A subsequent elevating effect upon other areas of curriculum may also accrue. Teachers estimate a total of 20 pupils in each grade who would benefit from participation in the program. The administrator can visualize immediate costs of special materials, special room with furniture, and salary for a remedial teacher. These costs may be defrayable through E.S.E.A. Title I assistance, with only the finding of a room as the real stumbling block. However, a teacher has questioned the project as to the possible outcome or value of such a reading program. She

maintains that the children who will participate are mentally unable to profit from a special program, more especially so, as each has in the past received small group instruction in reading from the regular teacher without appreciable results.

What is the administrator to do? Must he base his decision entirely upon opinion? A search of past performance of children can give valuable information. Average students are expected to gain one year in reading ability during ten months of school attendance. School records may show slow readers to be gaining only eight instead of ten months. A gain of two months over this eight month gain is the objective of the special reading program.

If the measuring instrument to be used is the reading test from the Iowa Tests of Basic Skills, the standard deviation in terms of grade equivalent is about 14 months. Reference to Table I using the column headed "14" reveals that if all 60 pupils are used (row 60) the chance variation (3.61) is greater than the hoped for gain (2 months) in reading competence. If the program were extended to run an added year, a hoped for gain of four months over the expected gain would then be judged as significant.

Should the experimental design employ control and experimental groups, the total number of pupils would then be cut in half. Reference to Table 1 reveals the chance limit to have increased to 5.11 months (column 14 and row 30) as a result of reduction of sample

size. Thus, the special reading program would have to now show a 2-month gain for 3 years (or 6 months in all) to register significant results.

It is evident, therefore, that Table 1 can be helpful in many ways. It can not only be used to determine the probability of success of different sample sizes, it can suggest the length of the project, and can also aid in determining the experimental design most likely to produce significant findings through control of sample size.

DIFFERENCE OF

95% Level of

N Sample Size	Standard Deviation 1	2	3	4	5	6	7	8	9	10	11	12	13
10	.63	1.26	1.90	2.53	3.16	3.79	4.43	5.06	5.69	6.32	6.96	7.59	8.22
20	.45	.89	1.34	1.79	2.24	2.68	3.13	3.58	4.02	4.47	4.92	5.37	5.81
30	.37	.73	1.10	1.46	1.83	2.19	2.56	2.92	3.29	3.65	4.02	4.38	4.75
40	.32	.63	.95	1.26	1.58	1.90	2.21	2.53	2.85	3.16	3.48	3.79	4.11
50	.28	.57	.85	1.13	1.41	1.70	1.98	2.27	2.55	2.83	3.11	3.39	3.68
60	.26	.52	.77	1.03	1.29	1.55	1.81	2.07	2.32	2.58	2.84	3.10	3.36
70	.24	.48	.72	.96	1.20	1.43	1.67	1.91	2.15	2.39	2.63	2.87	3.11
80	.22	.45	.67	.89	1.12	1.34	1.57	1.79	2.01	2.24	2.46	2.68	2.91
90	.21	.42	.63	.84	1.05	1.26	1.48	1.69	1.90	2.11	2.32	2.53	2.74
100	.20	.40	.60	.80	1.00	1.20	1.40	1.60	1.80	2.00	2.20	2.40	2.60
125	.18	.36	.54	.72	.89	1.07	1.25	1.43	1.61	1.79	1.97	2.15	2.33
150	.16	.33	.49	.65	.82	.98	1.14	1.31	1.47	1.63	1.80	1.96	2.12
175	.15	.30	.45	.60	.76	.91	1.06	1.21	1.36	1.51	1.66	1.81	1.97
200	.14	.28	.42	.57	.71	.85	.99	1.13	1.27	1.41	1.56	1.70	1.84
250	.13	.25	.38	.51	.63	.76	.89	1.01	1.14	1.26	1.39	1.52	1.64
300	.12	.23	.35	.46	.58	.69	.81	.92	1.04	1.15	1.27	1.39	1.50
350	.11	.21	.32	.43	.53	.64	.75	.86	.96	1.07	1.18	1.28	1.39
400	.10	.20	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30
450	.09	.19	.28	.38	.47	.57	.66	.75	.85	.94	1.04	1.13	1.23
500	.09	.18	.27	.36	.45	.54	.63	.72	.80	.89	.98	1.07	1.16
550	.09	.17	.26	.34	.43	.51	.60	.68	.77	.85	.94	1.02	1.11
600	.08	.16	.24	.33	.41	.49	.57	.65	.73	.82	.90	.98	1.06
650	.08	.16	.24	.31	.39	.47	.55	.63	.71	.78	.86	.94	1.02
700	.08	.15	.23	.30	.38	.45	.53	.60	.68	.76	.83	.91	.98
750	.07	.15	.22	.29	.37	.44	.51	.58	.66	.73	.80	.88	.95
800	.07	.14	.21	.28	.35	.42	.49	.57	.64	.71	.78	.85	.92
850	.07	.14	.21	.27	.34	.41	.48	.55	.62	.69	.75	.82	.89
900	.07	.13	.20	.27	.33	.40	.47	.53	.60	.67	.73	.80	.87
950	.06	.13	.19	.26	.32	.39	.45	.52	.58	.65	.71	.78	.84
1000	.06	.13	.19	.25	.32	.38	.44	.51	.57	.63	.70	.76	.82

MEANS BY CHANCE

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Confidence of Test Instrument

14	15	16	17	18	19	20	21	22	23	24	25	N Sample Size
8.85	9.49	10.12	10.75	11.38	12.02	12.65	13.28	13.91	14.55	15.18	15.81	10
6.26	6.71	7.16	7.60	8.05	8.50	8.94	9.39	9.84	10.29	10.73	11.18	20
5.11	5.48	5.84	6.21	6.57	6.94	7.30	7.67	8.03	8.40	8.76	9.13	30
4.43	4.74	5.06	5.38	5.69	6.01	6.32	6.64	6.96	7.27	7.59	7.91	40
3.96	4.24	4.53	4.81	5.09	5.37	5.66	5.94	6.22	6.51	6.79	7.07	50
3.61	3.87	4.13	4.39	4.65	4.91	5.16	5.42	5.68	5.94	6.20	6.45	60
3.35	3.59	3.82	4.06	4.30	4.54	4.78	5.02	5.26	5.50	5.74	5.98	70
3.13	3.35	3.58	3.80	4.02	4.25	4.47	4.70	4.92	5.14	5.37	5.59	80
2.95	3.16	3.37	3.58	3.79	4.01	4.22	4.43	4.64	4.85	5.06	5.27	90
2.80	3.00	3.20	3.40	3.60	3.80	4.00	4.20	4.40	4.60	4.80	5.00	100
2.50	2.68	2.86	3.04	3.22	3.40	3.58	3.76	3.94	4.11	4.29	4.47	125
2.29	2.45	2.61	2.78	2.94	3.10	3.27	3.43	3.59	3.76	3.92	4.08	150
2.12	2.27	2.42	2.57	2.72	2.87	3.02	3.17	3.33	3.48	3.63	3.78	175
1.98	2.12	2.26	2.40	2.55	2.69	2.83	2.97	3.11	3.25	3.39	3.54	200
1.77	1.90	2.02	2.15	2.28	2.40	2.53	2.66	2.78	2.91	3.04	3.16	250
1.62	1.73	1.85	1.96	2.08	2.19	2.31	2.42	2.54	2.66	2.77	2.89	300
1.50	1.60	1.71	1.82	1.92	2.03	2.14	2.24	2.35	2.46	2.57	2.67	350
1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50	400
1.32	1.41	1.51	1.60	1.70	1.79	1.89	1.98	2.07	2.17	2.26	2.36	450
1.25	1.34	1.43	1.52	1.61	1.70	1.79	1.88	1.97	2.06	2.15	2.24	500
1.19	1.28	1.36	1.45	1.54	1.62	1.71	1.79	1.88	1.96	2.05	2.13	550
1.14	1.22	1.31	1.39	1.47	1.55	1.63	1.71	1.80	1.88	1.96	2.04	600
1.10	1.18	1.26	1.33	1.41	1.49	1.57	1.65	1.73	1.80	1.88	1.96	650
1.06	1.13	1.21	1.29	1.36	1.44	1.51	1.59	1.66	1.74	1.81	1.89	700
1.02	1.10	1.17	1.24	1.31	1.39	1.46	1.53	1.61	1.68	1.75	1.83	750
.99	1.06	1.13	1.20	1.27	1.34	1.41	1.48	1.56	1.63	1.70	1.77	800
.96	1.03	1.10	1.17	1.23	1.30	1.37	1.44	1.51	1.58	1.65	1.71	850
.93	1.00	1.07	1.13	1.20	1.27	1.33	1.40	1.47	1.53	1.60	1.67	900
.91	.97	1.04	1.10	1.17	1.23	1.30	1.36	1.43	1.49	1.56	1.62	950
.89	.95	1.01	1.08	1.14	1.20	1.26	1.33	1.39	1.45	1.52	1.58	1000